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pirical, and to test the comparative strength of the two opposite tendencies to fusion, according as the images are homonymous or heteronymous. The experiments were conducted between the limits of the parallel and the convergent position of the eyes. For testing the native and unalterable functions of binocular accommodation, a prism was used in front of one of the eyes, both horizontally and vertically. When the prism was placed horizontally, so as to produce homonymous images, the movements for fusion had to be divergent and the localization was apparently farther off than in reality, and when placed to produce heteronymous images, involving convergent movements for fusion, the localization was nearer than in reality. These facts are taken as indicating a native and fixed function for localization by binocular adjustment. The result was similar for the vertical position of the prism, which had the effect of throwing the images upon different planes in the retina, and there was no appreciable tendency to fusion, even when they could be brought into the median plane. The author, however, found some slight limitations to the absolute fixity of this law. Even in those cases where vertical fusion seemed to take place, there was reason to regard them as abnormal and exceptional. In regard to the comparative strength of the convergent and the parallel movements of the eyes, experiment seemed to show that the convergent were slightly the stronger.

J. H. HYSLOP.

Ueber den Einfluss der Geschwindigkeit des Pulses auf die Zeitdauer der Reactionszeit bei Schalleindrücken. VAN BIERVLIET. Wundt's Philos. Studien, X. (1894), 160-167.

Dr. van Biervliet has measured the sensory reaction-times of eleven university students to auditory stimulation and compared these with pulse rates found by careful counting just before taking the reactions. The instrument used was the Hipp chronoscope, regulated at intervals with the new model Leipzig *Control-hammer*. Six of the eleven subjects showed a regular quickening of the reaction-time with acceleration of the pulse. Four others showed something of the same tendency, but failed at the extremes of fast or slow pulse, and one observer exactly reversed the rule. In view of these more or less discordant cases and of the large size of the mean variation (as in all sensory reactions) when compared with the differences to be established, the quickening of the reaction-time with the pulse rate must be regarded as probable rather than proved. No statement is made as to possible changes in pulse rate during the time of taking a series of reactions, nor are the reasons given for the high pulse rates found sufficiently explicit. One would like to know how far the quickening was due to active exercise and how far to excitement, which last has already been shown (this JOURNAL, IV., 524) to quicken both sensory and muscular reaction-times. Possibly these data may be more fully furnished in the report of experiments on reactions to optical and dermal stimuli that is to be furnished later.

Einige Versuche mit der Wunderscheibe. GRÜTZNER. Pflüger's Archiv, LV., 1893, 508-520.

The author first describes two lantern methods for demonstrating stroboscopic phenomena simultaneously to a large company of spectators. The first presents a single figure in motion, the second a full set of figures. For the full description of these, which cannot be described in short space without the diagrams, the reader is

referred to the original. He next describes a method of mixing colors with the stroboscope, which, in principle, is similar to that of the color top, and might occasionally prove useful. Next follows an application of the stroboscope to the demonstration of simultaneous contrast. Suppose, for simplicity, a stroboscope disk with four slits, two of which (lying in the same diameter) are covered with red glass, the other two being left free. Opposite the stroboscopic disk, on the same axis, is placed a white disk carrying two small black circles. When this combination of disks is set in rapid rotation, the observer sees a white or light red field, in which four dots appear to lie, two red brown and two green, the latter colored by contrast. [Such an experiment seems, like many of Hering's, to speak emphatically for the physiological theory of simultaneous contrast.] A fourth experiment of a more psychological character is the following: A series of stroboscopic pictures in black and white, representing boys playing leap-frog, was taken, and, after it had been viewed for a short time with the stroboscope, the pictures representing one boy in the air exactly over the other, were changed by covering the boy in the air with white paper, those showing the initial and concluding stages of the leap remaining unchanged. The alteration, however, made no difference whatever in the conviction of the observer that he actually saw one boy in the air above the other. Indeed, the suggestion involved in the mere beginning of the spring was sufficient to cause the seeing of the whole of it. A very inviting means is thus offered — as the author points out — for the study of suggested illusion and hallucination. [Work along this line has apparently already been undertaken at Cornell; see page 414 of this JOURNAL.]

Pedagogisch-psychometrische Studien. Zwei vorläufige Mitteilungen.
DR. ROBERT KELLER in Winterthur. Biol. Centralblatt. Bd.
XIV., No. 1, 2 and 9.

The present study was suggested by Mosso's experiments upon the influence of mental work upon the ergographic fatigue curve. If fatigue is due to a general deterioration of the blood, we may expect it to affect the muscles and that we may find a test, and possibly a measure of it, in the ergograph record. The latter may not be without value as a test of mental fatigue, even if this is of a more local character, since we may expect the strength and number of the impulses sent down by the brain to be diminished by it. In fact, may it not be possible to determine by this method the relative difficulty and the best grouping of studies in schools? The experiments are few in number and were all made upon a boy of fourteen.

The aim of the first is to study the effect of rapid reading upon the ergograph record. The general plan of an experiment is about the same throughout. Four ergograph records were taken, with intervals of about half an hour. A part of these intervals was spent in rapid reading, or other fatigue work. An hour's rest was then taken and an exactly similar experiment begun. Two experiments were made in the morning, and one, sometimes two, in the afternoon. The general result is that rapid reading at first increases, then lessens the ergograph record, and that the record after the hour's rest is usually lower than the fourth record. The fact that this order is repeated in successive experiments on the same day is some guarantee for a causal relation between mental work and changes in the ergograph record. It is also in harmony with Mosso's results. Similar experiments with the rapid reading